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PATENT SPECIFICATION

DRAWINGS ATTACHED

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Inventors: JOHN MICHAEL CONWAY-JONES and NIGEL WICKHAM LEWIS.

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COMPLETE SPECIFICATION

Bearings for Supporting Mainly Vertical Loads

We, THE GLACIER METAL COMPANY LIMITED, a Company registered under the Laws of Great Britain, of 368 Ealing Road, Alperton, Wembley, Middlesex, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to bearing assemblies of the kind employed for supporting vertical or mainly vertical loads while permitting a degree of movement in a mainly horizontal direction due to expansion and contraction of the part supported, such expansion and contraction being caused by temperature variations and/or variations in the load applied to the part supported. The invention is applicable to bearing assemblies of the above kind as used for example in steel and pre-cast or pre-stressed concrete or other structures such as bridges or for supporting boilers, pipes or the like where the length or other horizontal dimensions of the part to be supported are such that changes in dimension due to expansion and contraction cannot satisfactorily be accommodated by deflection of the supporting parts.

The invention includes embodiments in which provision is made to allow for varying deflection of the part to be supported due to changes in the vertical load on the part being supported and/or the application of or variations in lateral loads in addition to allowing for expansion and contraction. Various forms of bearing assembly of the kind in question have been proposed including arrangements in which the necessary loads are transmitted through and the required relative sliding movement permitted by a bearing comprising two steel parts having surfaces between which lie a bronze part attached to one of the steel parts, together making a steel/bronze/steel sandwich the sliding parts being packed with grease, and a bearing assembly in which a layer of rubber is interposed between the appropriate parts so as to transmit the load by compression and permit the relative horizontal movements by deformation in shear. Of these prior proposals experience shows that in the former the coefficient of friction rises substantially as the grease is squeezed out, and as replacing the grease is a major operation the structures have to be designed to resist the increased forces arising when the grease is absent, while, apart from the risk of the rubber in the latter prior proposal ageing or otherwise deteriorating under the effects of shear or environmental conditions, the degree of relative horizontal movement permitted is limited by the thickness of the rubber and, if this thickness is increased to allow for greater relative horizontal movements, the positive location of the parts between which the rubber lies requires to be dealt with by other means. It is an object of the present invention to provide improved bearing assemblies of the kind in question which will not only meet the practical requirements of such bearings in a satisfactory manner but will tend to remain effective without attention for long periods of time. For example in the case of a bridge bearing of the kind in question it may be desirable for the bearing to remain effective without attention for as long as 100 years.

A bearing assembly according to the present invention for supporting a mainly vertical load while permitting a degree of movement in a mainly horizontal direction due, for example, to thermal expansion and contraction of the part supported, comprises an upper rigid member formed or arranged to take a mainly downward load from a part

to be supported, an intermediate rigid member arranged to transmit mainly vertical loads downwards and provided with an upwardly facing surface which cooperates with and is capable of sliding relatively to a cooperating downwardly facing surface on the upper rigid member, and a lower rigid member arranged to transmit a load to a load-supporting part and having an upwardly facing surface which cooperates with and is capable of sliding relatively to a cooperating downwardly facing surface on the intermediate rigid member, the surfaces constituting at least one of the two pairs of cooperating relatively sliding surfaces being of part-cylindrical form while at least one of the two surfaces constituting each pair is formed of self-lubricating material.

In a preferred arrangement according to the invention the surfaces constituting the pair of cooperating sliding surfaces respectively on the upper rigid member and the intermediate rigid member are part-cylindrical and the surfaces constituting the pair of cooperating sliding surfaces respectively on the intermediate rigid member and the lower rigid member are also part-cylindrical, the axes of curvature of the two pairs of cooperating sliding surfaces lying at right angles to one another. Thus, in such an arrangement each of the pairs of cooperating sliding surfaces permits linear sliding movement in a direction parallel to the axis of curvature of such surfaces and also limited rocking movement about that axis between the two members on which the surfaces are formed, whereby the assembly as a whole allows for relative movement between the upper rigid member and the lower rigid member in two horizontal directions at right angles to one another as well as limited relative rocking movement between these members about two axes at right angles to one another.

Preferably at least one of each of the two surfaces constituting each pair of cooperating sliding surfaces is the surface of a layer of self-lubricating material, the self-lubricating material conveniently comprising or including polytetrafluorethylene (P.T.F.E.), in which case the bearing material preferably comprises a thin metallic strip, the sliding surface at least of which is porous or pitted, with the pores or pits substantially filled with P.T.F.E. Such a metallic strip may comprise for example, a backing, e.g. of steel, to which is bonded a layer of porous bronze the surface at least of which is impregnated with P.T.F.E. with or without a proportion of lead. Moreover the sliding surface with which the surface of the self-lubricating material cooperates may in such cases conveniently be the surface of a layer of stainless steel or chromium.

It will be understood that in such arrangements, in which the sliding surface is constituted by the surface of a thin strip of self-lubricating material, the strip will be suitably attached to the body of the upper rigid member, intermediate rigid member or lower rigid member as the case may be.

One construction according to the invention is shown by way of example in the accompanying drawings, in which

Figure 1 is a plan view of the assembly,

Figure 2 is a cross-section in the plane 2-2 of Figure 1,

Figure 3 is a cross-section in the plane 3-3 of Figure 1, and

Figures 4 and 5 are respectively a diagrammatic exploded view and an assembled view of the bearing assembly to illustrate the manner of operation of such assembly.

In the construction illustrated the assembly comprises an upper member comprising a body part 11 formed, for example, as a casting and provided with studs 11A by which it can be rigidly secured to the part to be supported, a lower member comprising a body part 12 provided with studs 12A by which it can be rigidly secured to a supporting part, and an intermediate member having a body part 13. In this construction, as will be clear from Figures 2 and 3, the lower surface of the upper part 11 is convex part-cylindrical apart from a recess 11B, while the upper surface of the lower part 12 is a convex part-cylindrical apart from a recess 12B the axes of the cylinders being at right angles to one another when viewed in plan, while the upper and lower surfaces of the intermediate part 13 are correspondingly concave part-cylindrical, apart from projections 13A and 13B which extend respectively into the recesses 11B and 12B. Bonded to the lower convex surface of the upper part 11 is a stainless steel plate 14, this bonding being effected with the interposition of asbestos cloth by means of an epoxy resin, the cloth preventing electrolytic action which might otherwise occur due to direct contact between the stainless steel and the body part 11, while there is similarly bonded to the upper convex surface of the lower part 12 is a stainless steel plate 15. Bonded to upper and lower concave surfaces or the intermediate part 13 are strips of metallic self-lubricating material 16 of known type comprising a solid bronze backing having bonded to its upper face a layer of porous bronze impregnated with a mixture of P.T.F.E. and lead, for example in the manner described in the specification of the present applicants' British Patent No. 824,940. The bonding of the material 16 to the part 13 may be effected by an epoxy resin in combination with asbestos fibre. Resilient sealing "rings" 17 lying in grooves in the intermediate member 13 surround the strips of self-lubricating material and slide upon the adjacent surfaces of the stainless

steel plates 14, 15.

In the construction shown it will be seen that relative sliding movement can take place between the parts 11 and 13 in a direction parallel to the axis of curvature of the part-cylindrical surfaces provided thereon in addition to a limited degree of rocking movement about the axis of curvature of such part-cylindrical surfaces, while similarly relative sliding and limited relative rocking movement can take place between the parts 12 and 13 in relation to the axis of curvature of their associated part-cylindrical surfaces.

In Figure 4 the relative sliding movement between the parts 11 and 13 is indicated by the arrows D, while the relative rocking movement between these parts is indicated by the arrows E, the relative sliding movement between the parts 12 and 13 is indicated by the arrows F while the relative rocking movement between these parts is indicated by the arrows G. In Figure 5, in which the bearing assembly is assumed to be supporting one end of a girder 18 from a supporting structure 19, the relative sliding movement with expansion and contraction of the girder permitted between the parts 11 and 13 is indicated by the arrows H, while the relative rocking movement due to bending of the girder in the vertical plane, permitted by rocking movement between the parts 12 and 13 is indicated by the arrows J.

Moreover where high loadings are anticipated the self-lubricating material in the construction illustrated may be supported upon a layer including compressed asbestos fibre, while where low loadings are anticipated it may in some cases be supported on a thin layer of synthetic rubber, and in either event the purpose of employing a somewhat compressible layer to support the self-lubricating material is to assist in ensuring substantially even distribution of load over the surface.

WHAT WE CLAIM IS:—

1. A bearing assembly for supporting a mainly vertical load while permitting a degree of movement in a mainly horizontal direction, due, for example, to thermal expansion and contraction of the part supported, comprising an upper rigid member formed or arranged to take a mainly downward load from a part to be supported, an intermediate rigid member arranged to transmit mainly vertical loads downwards and provided with an upwardly facing surface which co-operates with and is capable of sliding relatively to a co-operating downwardly facing surface on the upper rigid member, and a lower rigid member arranged to transmit a load to a load-supporting part and having an upwardly facing surface which co-operates with and is capable of sliding relatively to a co-operating downwardly facing surface on the intermediate rigid member, the surfaces constituting at least one of the two pairs of co-operating relatively sliding surfaces being of part-cylindrical form while at least one of the two surfaces constituting each pair is formed of self-lubricating material.

2. A bearing assembly for supporting vertical or mainly vertical loads while permitting a degree of movement in mainly horizontal directions, due, for example, to thermal expansion and contraction of the part supported, comprising an upper rigid member formed or arranged to take a mainly downward load from a part to be supported, an intermediate rigid member provided with an upwardly facing part-cylindrical surface which co-operates with and is capable of sliding relatively to a co-operating downwardly facing part-cylindrical surface provided on the upper rigid member, and a lower rigid member having an upwardly facing part-cylindrical surface co-operating with and capable of sliding relatively to a co-operating downwardly facing part-cylindrical surface on the intermediate rigid member, wherein the axes of curvature of the two pairs of co-operating sliding surfaces lie at right angles to one another and at least one of the two surfaces constituting each pair is formed of self-lubricating material.

3. A bearing assembly as claimed in Claim 1 or Claim 2 wherein at least one of each of the pairs of co-operating relatively sliding surfaces is the surface of a layer of self-lubricating material.

4. A bearing assembly as claimed in Claim 3 wherein the self-lubricating material comprises or includes polytetrafluorethylene.

5. A bearing assembly as claimed in Claim 3 wherein the self-lubricating bearing material comprises a metallic strip, the sliding surface at least of which is porous or pitted with the pores or pits substantially filled with polytetrafluorethylene.

6. A bearing assembly as claimed in Claim 5, in which the self-lubricating bearing material comprises a metal backing to which is applied and bonded a layer of porous bronze the surface layer constituting the bearing surface at least of which is impregnated with polytetrafluorethylene with or without a proportion of lead.

7. A bearing assembly as claimed in Claim 4 or Claim 5 or Claim 6 in which the bearing surface with which the self-lubricating material co-operates is the surface of a layer of stainless steel, or chromium.

8. A bearing assembly as claimed in Claim 4 or Claim 5 or Claim 6 or Claim 7, in which the layer of self-lubricating material is supported upon a somewhat compressible layer.

9. A bearing assembly as claimed in any one of Claims 4 to 8, in which the bearing surface of the layer of self-lubricating

material is surrounded by a sealing strip arranged to bear resiliently upon the co-operating bearing surface so as to exclude the entry of foreign matter between the relatively sliding surfaces.

10. A bearing assembly as claimed in any one of the preceding claims having combined therewith means by which the upper and lower members of the bearing assembly can be detachably secured to one another for transport, and can then be released from one another after assembly in position.

11. A bearing assembly as claimed in any one of the preceding claims in which stop means are provided to limit the relative sliding movement between the upper rigid member and the intermediate rigid member and between the intermediate rigid member and the lower rigid member under abnormal stress due, for example, to the supported part being struck by a heavy object.

12. A bearing assembly constructed and arranged substantially as described with reference to the drawings.

KILBURN & STRODE,
Chartered Patent Agents,
Agents for the Applicants.

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1 SHEET

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.

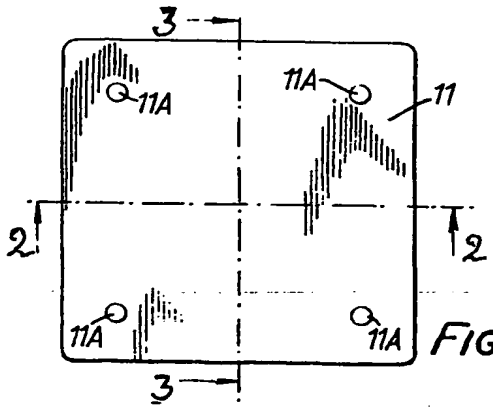

FIG. 1.

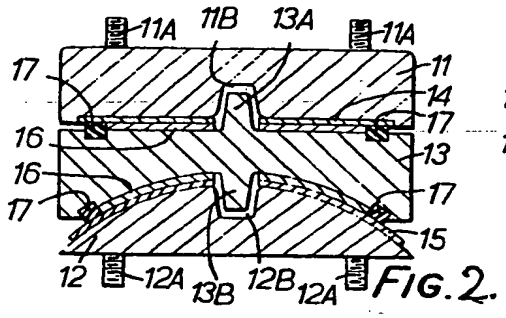

FIG. 2.

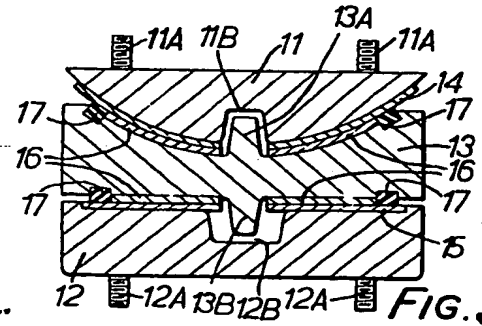

FIG. 3.

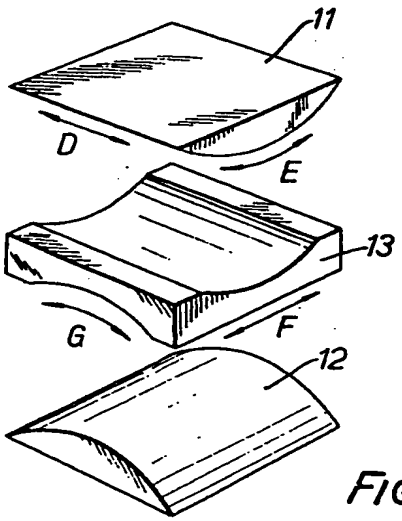

FIG. 4.

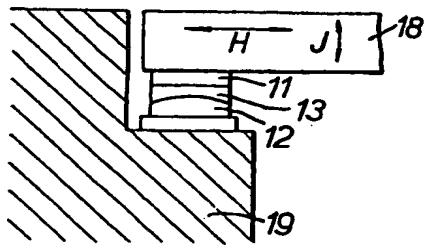

FIG. 5.